

470027

FLOOD INSURANCE STUDY

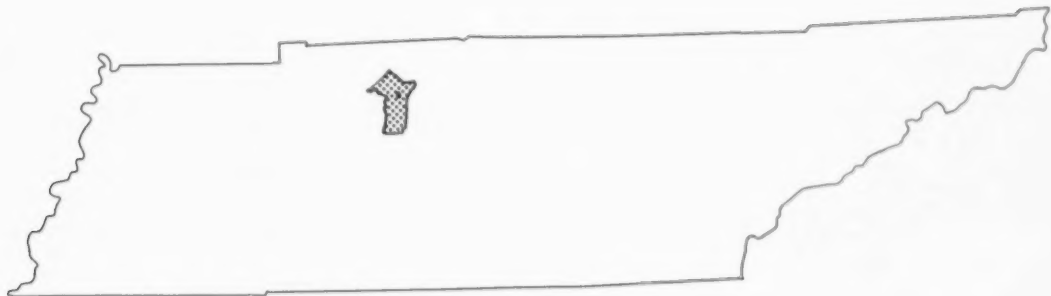


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TOWN OF ASHLAND CITY,
TENNESSEE
CHEATHAM COUNTY



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federal emergency management agency
federal insurance administration

COMMUNITY NUMBER - 470027

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PUBLISHED SEPARATELY:

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FLOOD INSURANCE STUDY THE TOWN OF ASHLAND CITY, TENNESSEE

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Ashland City, Cheatham County, Tennessee, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert the Town of Ashland City to the regular program of flood insurance by the Federal Insurance Administration (FIA). Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these Federally-supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1 (d). In such cases, however, it shall be understood that the state (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the Nashville District, U. S. Army Corps of Engineers, for the Federal Insurance Administration, under Interagency Agreement No. IAA-H-18-78, Project Order No. 17. This study was completed in June 1979.

1.3 Coordination

In November 1977, a meeting was held in the City Hall of Ashland City to determine which stream reaches within the city required study and the method of study. Present at the meeting were representatives of the Nashville District, Corps of Engineers (COE), the Federal Insurance Administration (FIA), and city officials. During the course of the study, coordination with city officials was maintained to insure acceptability of the final product.

The final CCO meeting was held on November 28, 1979, with representatives of the COE, FIA, and the city in attendance.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the Town of Ashland City, Cheatham County, Tennessee. The area of study is shown on the Vicinity Map (Figure 1).

The area selected for study is approximately 2 miles in length between River Miles 157.2 and 159.1 on the Cumberland River. This area was selected for study by detailed methods with priority given to all known flood hazard areas, and areas of projected development or proposed construction for the next five years, through May 1984. There were no areas of approximate study identified.

The Cumberland River drains an area of 17,914 square miles and the watershed occupies portions of Kentucky and Tennessee. The river is formed by the confluence of Poor and Clover Forks in southeastern Kentucky. From there, the river flows generally southwestward towards Nashville where it turns northwestward toward its confluence with the Ohio River. Topography in the basin varies from rugged mountains in the eastern or headwater portion to a rolling plateau in the western sector, with elevations ranging from 4,150 feet above the National Geodetic Vertical Datum of 1929 (NGVD) in the Cumberland Mountains to 350 feet along the divide near the mouth. In general, the river flows on or near bedrock, and the channel is well defined with relatively stable banks. The length of the stream is 694 miles, with a total fall of 840 feet from source to mouth.

In the vicinity of Ashland City, the flood plain averages about 4,000 feet in width and is bounded by rather steep hills. The river channel is 600 to 700 feet in width and the streambed averages about elevation 355 feet NGVD.

2.2 Community Description

The first white settlement in what is now Cheatham County dates back to about 1780, when Adam Binkley and family settled in the vicinity of Sycamore Mills. In about 1796, Traxton Lee, John Lee, and Rev. Robert Heaton settled near the spot where the Town of Ashland City was located 60 years later. Nearly all of the early settlers of the Ashland City-Cheatham County area came from Virginia and the Carolinas.

The center of the new county was found to be on the north side of the Cumberland River on the land of James Lenox. The County Court acquired 50 acres of the Lenox property for \$713 for the purpose of establishing the county seat. Following the purchase of the property, the town was surveyed and plotted and named Ashland (later changed to Ashland City).



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Federal Insurance Administration

TOWN OF ASHLAND CITY, TN

APPROXIMATE SCALE



VICINITY MAP

FIGURE 1

There is very little development in the flood plain in the reach of the river covered by this study. Most of the flood plain lands have been either acquired by the Federal Government for project purposes or are used by private landowners for agriculture (Reference 1).

2.3 Principal Flood Problems

The main flood season in the Ashland City area is winter and early spring, December through April. It would be an extremely rare situation to have a large flood at a time other than the usual flood season. However, summer-time floods can happen; for example, as a result of decadent tropical storms.

Historically significant flooding on the Cumberland River in the vicinity of Ashland City has occurred in January 1927, January 1937, February 1948, February 1950, March 1962, and March 1975. The largest flood of record (regulated) occurred on March 15, 1975. This flood has a recurrence interval of 140 years. Damage in Ashland City caused by this flood totaled approximately \$400,000.

2.4 Flood Protection Measures

Wolf Creek Dam (Lake Cumberland) on the Cumberland River, Dale Hollow Dam on the Obey River, Center Hill Dam on the Caney Fork River, and J. Percy Priest Dam on the Stones River reduce the height and frequency of flooding in the vicinity of Ashland City. Cordell Hull and Old Hickory Reservoirs, on the Cumberland River upstream from Ashland City, are primarily for navigation, recreation, and power and have no significant effect on flood heights within the study reach. Cheatham Lock and Dam, 9.3 miles downstream from Ashland City, is operated primarily as a run-of-river power plant for navigation and recreation. Flood crests at Ashland City are not affected by Cheatham Dam.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, and 500-year period (recurrence intervals), have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term, average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than one year are considered. For example, the

risk of having a flood which equals or exceeds the 100-year flood (one percent chance of annual occurrence) in any 50 year period is about 40 percent (four in 10), and for any 90 year period, the risk increases to about 60 percent (six in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

Flood flows on the Cumberland River are regulated by a system of large flood control reservoirs. Because of varying levels of historical flood control, streamflow records exhibit a time-variant behavior. Use of a conventional Log-Pearson Type III flood frequency analysis as described in Water Resources Council (WRC) Bulletin 17 (Reference 2) is not appropriate in this case. A special study was conducted to develop regulated flood frequency flows for the Cumberland River (Reference 3).

A storm rainfall generation computer program was used to develop a 200-year synthetic rainfall record for the Cumberland River Basin. Significant flood-producing storms of the 200-year generated record were applied to a basin runoff-routing simulation model to produce streamflow discharges at central points. Results of the simulation model were analyzed to estimate discharge frequency curves. These discharge frequency curves were then combined with a graphical analysis of period of record regulated flow data developed by the Nashville District to establish adopted discharge frequency curves at all major river control points.

Results of the regulated frequency study were found to yield statistically reliable estimates of floods up to and including the 100-year event. For events greater in magnitude than the 100-year event such as the 500-year flood, the statistical reliability of predicted flow was poor. Estimates of the 500-year flood discharges from the study were found to approximate the Corps of Engineers developed Standard Project Flood (SPF) for the majority of the Cumberland River. The SPF has been widely disseminated to the general public by the COE, to be used for design purposes of developments adjacent to the Cumberland River. Because of the low reliability of estimates for extremely rare events and to maintain consistency with previously published information, the SPF is used in lieu of 500-year flood for this study as shown on the profile (Exhibit I).

The peak discharge-drainage area relationships for the selected recurrence intervals are presented in Table I, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA (sq. miles)</u>	<u>PEAK DISCHARGES (cfs)</u>			
		<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR²</u>
CUMBERLAND RIVER At Mile 158	13,117 ¹	115,000	137,000	145,000	180,000

¹9,790 square miles controlled by reservoirs.

²Standard Project Flood used in lieu of 500-year flood.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flood sources.

Water-surface elevations of the floods were computed through use of the Corps of Engineers HEC-2 computer program (Reference 4). Existing cross sections used in previous hydrologic studies were supplemented with field surveyed cross sections to facilitate more precise computations of floodway limits. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

Manning Roughness Coefficients for these computations were assigned on the basis of previous studies by the COE, reconstitution of known flood events, and field inspection of flood plain areas of the streams studied in detail. Coefficients used range from 0.027 in the channel to 0.1 for the overbanks.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 feet, for floods of the selected recurrence intervals (Exhibit 1). Since the Cumberland River profiles have been developed continuously for a 283 mile reach, extending from Barkley Dam to Cordell Hull Dam, the starting elevations were established by the operating criteria for the Barkley Project. All elevations are measured from 1929 NGVD. Elevation reference marks used in the study are shown and described on the Flood Insurance Rate Map.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FIA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and the 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:12,000 with a contour interval of 20 feet. In cases where the 100- and the 500-year flood boundaries are close together, only the 100-year boundary has been shown.

The boundaries of the 100-year and SPF (500-year) floods are shown on the Flood Boundary and Floodway Map (Exhibit 3). Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Due to limitations of the map scale and/or lack of detailed topographic data, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the FIA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodway presented in this study was computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY		BASE FLOOD WATER SURFACE ELEVATION				
CROSS SECTION	DISTANCE ¹	WIDTH (FT)	SECTION AREA (SQ FT)	MEAN VELOCITY (FPS)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Cumberland River								
	157.20	3498/410 ²	73,832	2.0	401.9	401.9	402.9	1.0
	158.10	1,361 ³	35,690	4.1	402.0	402.0	403.0	1.0
	159.10	1,452 ³	34,187	4.2	402.2	402.2	403.2	1.0

¹Miles above mouth.
²Total width/width within corporate limits.
³Outside corporate limits.

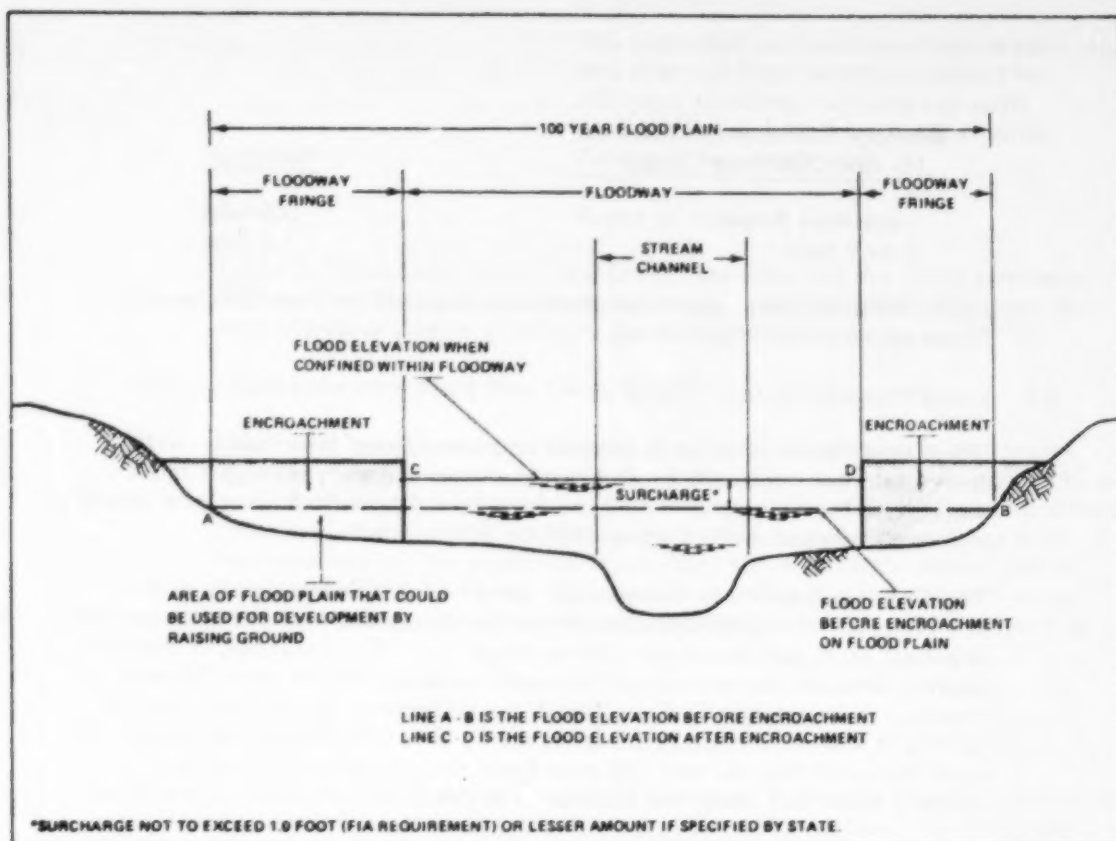
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FLOODWAY DATA

CUMBERLAND RIVER

TABLE 2



FLOODWAY SCHEMATIC

Figure 2

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FIA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF's), and flood insurance zone designations for each significant flooding source affecting Ashland City.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach.

<u>Average Difference Between 10- and 100-Year Floods</u>	<u>Variation</u>
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot

Using these criteria, only one reach was required for the Cumberland River within the study limits.

5.2 Flood Hazard Factors (FHF's)

The Flood Hazard Factor is used to correlate flood information with insurance rate tables. Correlations between property damages from floods and their assigned FHF's are used to set actuarial insurance premium rate tables based on FHF's from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between the water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, the accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHF's, the entire area of Ashland City was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations.

- Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHF's determined.
- Zone A13: Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF's.
- Zone B: Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; areas subject to certain types of

100-year shallow flooding where depths are less than 1.0 foot; or areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 3, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHF's, flood insurance zones, and base flood elevation for each flooding source studied in detail in the community.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Ashland is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FIA.

6.0 OTHER STUDIES

In April 1970, the U. S. Army Corps of Engineers, Nashville District, prepared a Flood Plain Information Report, "Ashland City, Tennessee." In 1975, the Nashville District undertook a water resources study of a ten county region in Middle Tennessee which includes Cheatham County. This study is projected to be completed in 1981. In addition, the Nashville District prepared a Flood Insurance study for the unincorporated areas of Cheatham County in June 1979. The results of all these studies have been coordinated and no conflicts exist.

7.0 LOCATION OF DATA

Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, 1375 Peachtree Street, N.E., Atlanta, Georgia 30309.

8.0 BIBLIOGRAPHY AND REFERENCES

1. Nashville District, Corps of Engineers, Flood Plain Information - Ashland City, Tennessee, April 1970.
2. U. S. Water Resources Council Guidelines for Determining Flood Flow Frequency Bulletin #17, March 1976.

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION ³
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.) ⁴			
Cumberland River Reach 1	0001,0003	-6.5	-2.3	+7.5	065	A13	402

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE

³ROUNDED TO NEAREST FOOT - SEE MAP

⁴Standard Project Flood used in lieu of 500-year flood.

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FLOOD INSURANCE ZONE DATA

CUMBERLAND RIVER

TABLE 3

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4. U. S. Army Corps of Engineers HEC, Computation of Water-Surface Profiles, Users Manual of HEC-2 Computer Program.

Nashville District, Corps of Engineers, Report on the March 1975 Cumberland River Basin Flood, April 1976.

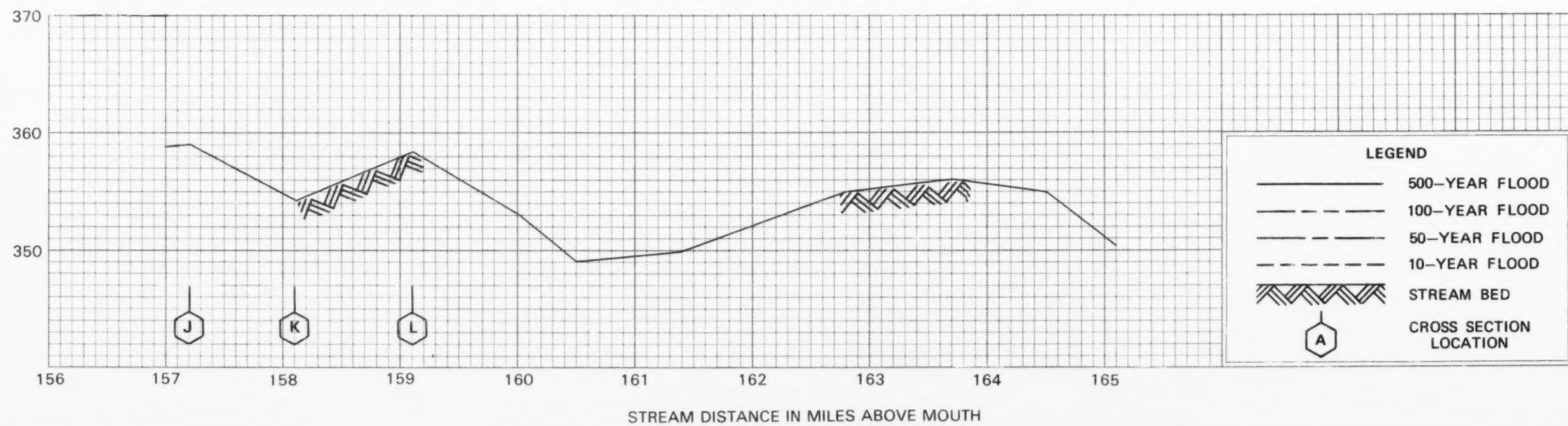
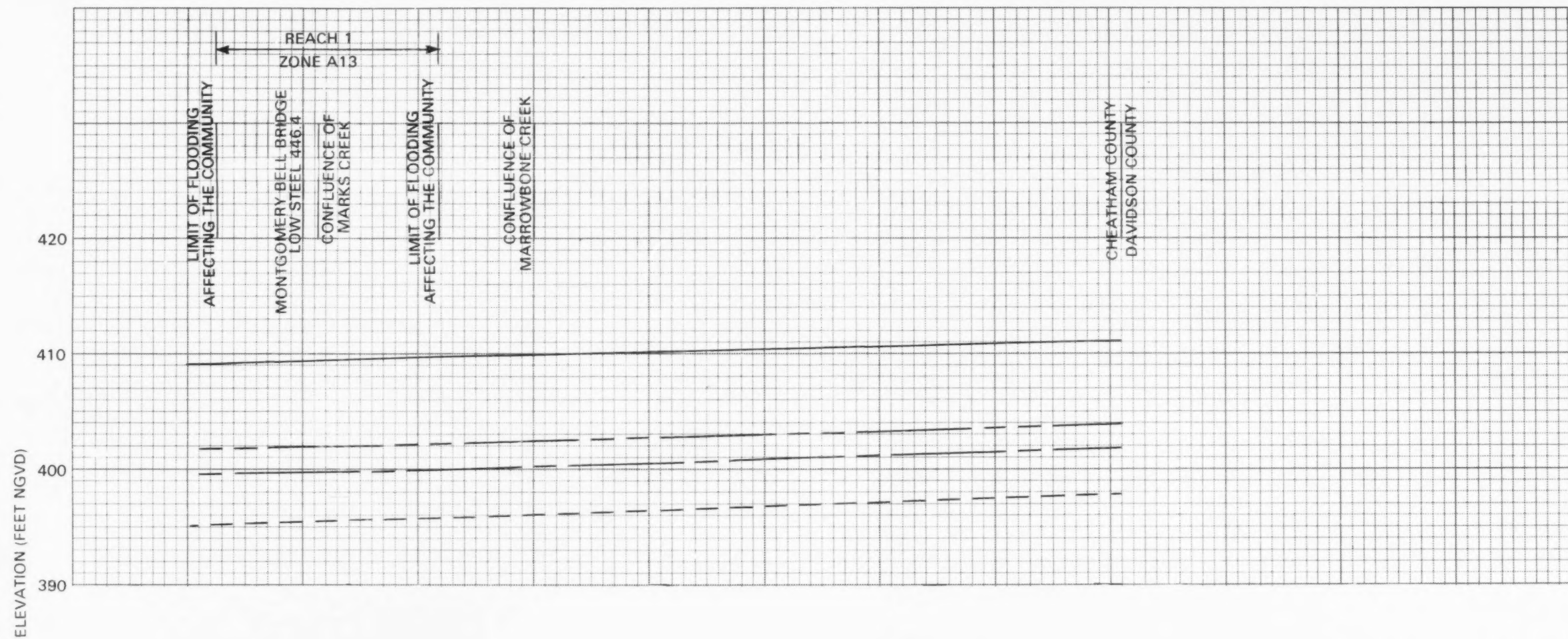
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U. S. Army Corps of Engineers, Backwater Curves in River Channels, EM 1110-1409, December 1959.

U. S. Water Resources Council Flood Plain Management Guidelines for Implementing E. O. 11988, 43FR, 6030, February 10, 1978.

U. S. Army Corps of Engineers Hydrologic Engineering Center, Flood Flow Frequency Analysis, Computer Program 723X6L7550, Users Manual, June 1976.



FLOOD PROFILES

CUMBERLAND RIVER

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01P